ON A DEVICE FOR MEASURING TRANSPARENCY

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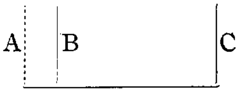
Since in the preceding article[1] only a general description of the Friedburg absorptiometer was intended, no attempt was made to give an exact theory of the instrument. As it proved, however, useful in measurements exacting a certain degree of accuracy, we consider it expedient to give a few details.

The instrument is represented in the following diagram.



A represents the opaque object, B the polarizer, and C the analyzer.

Denoting by E the intensity of the light transmitted by the opaque body, by I the intensity of the light transmitted by the analyzer, and by φ the angle through which the analyzer is turned from the initial position of maximum light, we have by the Law of Malus:

$$I = E\cos^2\varphi \qquad (1)$$

In comparing the transparency of two objects, each time we turn the analyzer to a point where further darkening is imperceptible. If we denote by subscripts $_1$ and $_2$ respectively the quantities referring to each object, we obtain from the preceding condition and from (1)

$$E_1\cos^2\varphi_1 = E_2\cos^2\varphi_2. \qquad (2)$$

During the experiment the intensity (S) of the source of light remains constant, that is

$$S_1 = S_2. \qquad (3)$$

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[1] L. H. Friedburg, "On a Device for Measuring Transparency:" Jour. Phys. Chem., 14, 84 (1910).

Now dividing both sides of (3) by $E_1 cos^2\varphi_1$ and $E_2 cos^2\varphi_2$ respectively, we obtain:

$$\frac{S_1}{E_1} : \frac{S_2}{E_2} = cos^2\varphi_1 : cos^2\varphi_2$$

But the ratio of the intensities of the impinging and transmitted light is the definition of transparency. We may, therefore, state the law of the instrument in the following way:

The transparencies of two objects are in the ratio of the squares of the cosines of the angles through which the analyzer is turned from the position of maximum light, to that where further darkening is imperceptible, the intensity of the source of light remaining constant.

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